***Review Article***

**Smart City Project Management: Designing an Agile Governance Framework for Sustainable Public Infrastructure Initiatives**

**Abstract**

The increasing complexity of 21st-century urban development has spurred a global move towards smart city initiatives associated with improving the quality of urban life, economic efficiency, and environmental sustainability. Smart city projects are by their nature interdisciplinary, have a multiplicity of stakeholders, evolve rapidly in technology, and must be sustainable over the long term which all create specific challenges to their management. In this review, a comprehensive, agile framework for smart city project governance is proposed which is geared towards dynamic smart city project environments, particularly sustainable public infrastructure projects. The framework integrates principles of agile project management, collaborative governance, and metrics to address well-known pitfalls in smart city initiatives including bureaucratic inertia, fragmented decision-making, and inactive citizen participation.

The proposed model focuses on iterative planning, adaptive policy in mechanisms, stakeholder co-creation, and performance evaluation in a continuous model using real-time data analytics. The applicability of the framework is validated by studying case studies of leading smart cities and extracting best practices from these. Furthermore, the study investigates the part played by digital tools such as IoT, big data, and AI, in improving transparency, accountability, and the responsiveness of project governance. The results indicate that an agile governance approach contributes to improving project operation efficiency and innovation capacity as well as the social and environmental resilience of public infrastructure projects. A model for practical and scalable intelligent and agile urban governance that facilitates sustainable urban transformation is the key contribution of this review.

**Keywords:** Smart City, Project Management, Agile Governance, Sustainable Infrastructure, Sustainability, Artificial Intelligence, Internet of Things, and Real-Time Data Analytics.

**1.0 INTRODUCTION**

Urbanisation is increasingly common around the globe as a way to build and grow communities. Over the years, more people have moved into cities worldwide. Large numbers of people are choosing to settle in cities every week. In 2050, around two-thirds of the world’s people will be urban residents, according to a United Nations report, with cities’ population set to double that of rural areas. The health and stability of the world’s future greatly depend on cities. People living in cities are going up swiftly, resulting in more road jams, trash, and greenhouse gases (Cocchia, 2014). As a result, a growing number of cities are now involved in smart city initiatives, using and mixing innovative information and communication technologies (ICT) (Chourabi et al., 2012). Europe will have the largest number of SC initiatives globally (Frost & Sullivan, 2018), with some parts due to the European Commission’s engagement in this respect as well. As the number of European SC initiatives grows and they try to implement SC initiatives facing technical managerial, governance, and financial challenges, it is argued that it is important to know the underlying processes for effective implementations (Alawadhi et al., 2012; Ojo et al., 2014). Some important characteristics that SC initiatives have in common with firms’ digital transformation (DT) initiatives are shared (Nam et al., 2011). Such characteristics include the use of infrastructure and service environment, based on ICT, and a great number of unique or different stakeholders involved in the change (Anthopoulos & Fitsilis, 2014). Furthermore, citizens are expecting more online information, convenience, and asynchronous handling of data and are expecting a more participation-centric approach rather than a public-centric model of governance, a concept of decoupling sociology of the administration and the user (Curwell et al., 2005). The usage of modern technology, accelerating the speed of change among other aspects, demands shorter planning horizons, exacerbating the issue with management (Turban et al., 2018).

Several governments have encouraged building a smart city to better handle city management and growth. Most studies say that smart city projects involve using current technologies to help make urban systems more efficient (Tan & Taeihagh, 2020). Most experts believe that by focusing on what local people require, smart city development enhances the daily lives of people (Huang-Lachmann, 2019). When physical, digital, and social systems are effectively brought together in cities to improve sustainability, prosperity, and inclusivity for local people such cities are called smart cities, according to ISO PAS 180 (2014). Mainly, the concept of a smart city is defined by the use of new ideas to tackle the increasing social, economic, and environmental issues growing cities face (Yigitcanlar et al., 2018). As cited by Lam and Yang (2020), it is predicted that there will be around $2 trillion of business opportunities related to smart cities by 2025.

Building smart cities brings about many obstacles. Lam and Yang (2020) point out that government budgets are being strained and much of their infrastructure requires updating. Alim and Polak (2016) explain that one obstacle to developing smart cities is the difficulty of obtaining public money. Multistakeholder development means including municipal bodies, residents, and different private and not-for-profit organizations with various intentions. Having modern services is necessary for a smart city, so providers must be highly inventive in what they do (Ojasalo & Kauppinen, 2016).

Essentially, smart cities are a paradigm of urban development developed based on the widespread application of sophisticated technologies to improve urban life. Although the exact definitions and application of smart cities may differ slightly, the larger idea is to develop an ecosystem in which the cities operate more efficiently, and sustainably and are livable in general. This goal is a great one, but reaching it includes some competing priorities across stakeholders, citizens, and industry groups matched with limited resources to bring those elements together and manage them. Hence in being a smart city, good governance must be part of effective management. Matters of broad governance have been well reviewed in the literature (for instance, smart city governance comprises a range of different, wide-ranging issues that are critical to its effective and efficient operation. Less covered in the literature, are the integration of agile governance frameworks for public infrastructure sustainability.

Agile methodologies integration into smart city project management is a transformative way of doing urban development. Typically, smart city initiatives are dynamic and complex which poses a problem for traditional governance structures. This review explores Agile Governance as a methodology that can increase public infrastructure projects' responsiveness, stakeholder engagement, and sustainability.

**2.0 LITERATURE REVIEW**

**2.1 Evolution of the smart city concept**

The evolution of the concept of a smart city has been truly revolutionary since it came into existence at the turn of the 21st century. Smart cities, however, have initially been mainly associated with advanced technology, including such systems as sensors, highspeed internet networks, big data platforms and so on (Komninos et al., 2018). However, the meaning of the expression Smart Cities has taken a different and much more holistic 42-focused approach regarding the enhancement of the quality of life of the whole society (Albino et al., 2019). Smart cities are thus seen today as a complex ecosystem where people, technology and the environment come together towards better urban solutions (Komninos et al., 2018). Though individual smart cities are technology projects, they are more than that: good governance, community participation and sustainability in all senses are equally big parts of the picture (Hollander, 2018). Different approaches and implementation models of smart cities in development have been adopted. Meijer and Bolivar (2021) elaborates that some cities are concentrating more on the development of technological infrastructure and some more focus on the enhancement of public services and citizen participation. Some cities also take a more integrated approach, that is addressing various urban elements at once.

**2.2 Challenges in smart city implementation**

However, while the smart city concept has so much potential, the problems related to feasibly putting them into practice are plenty. Some of the primary challenges are multidisciplinary and multi-stakeholder required to provide solutions to very complex urban problems (Iannacci & Lazzeroni, 2019). Additionally, smart city development halts due to limited resources, budgetary, and apparently human, and this is also true for developing countries (Rodríguez-Abitia & Bribiesca-Contreras, 2019). Finally, resistance to change, on the part of the government and society (Linders, 2019) is yet another challenge. It’s not something that happens overnight to change an organizational culture which by nature is bureaucratic and hierarchical, into one that is collaborative and adaptive (Wijnhoven, 2018). New technologies are also accompanied by legal concerns regarding privacy and security and the digital divide (Paskaleva, 2018).

**2.3 Smart City Governance**

Smart city governance involves efficient coordination of urban technologies, models and methods to use urban data; it involves the use of new communication and dissemination technologies; and finally, it involves the development of new forms of urban governance and organizations to integrate the technologies and the new forms of governance. The smart city governance literature has several authors. Rather, they look at the topic from a number of angles, most of which tackle (to varying degrees) what is critical to city governance and what are some new issues and unmet challenges of city operations. Next had it not been for Batty et al. (2012), they made a definition of smart city governance with four ideal poem conceptualizations of smart city governance: government of smart city, smart decision processes, smart administration and smart urban collaboration. Meijer and Bolívar (2015) and Pereira et al. (2018) also contributed to the framework on how to develop new smart governance models to design solutions for the challenges of the digital society, collaborative governance, information sharing, citizen engagement and transparency and openness. In the case of smart governance: what it means is that we make the right policies or policy decisions and we do it right (Babić et al., 2022).

 The promotion of smart city initiatives without the transformation of the apparatus, structure and processes of the government is also part of it (Ngo & Le, 2021). Smart governance's main goal is resource management in a considered environment-friendly way and humanistic principles (Mukhlis et al., 2021). Inclusive development and environmentally friendly management of resources in line with humanist principles require smart governance (Mukhlis et al., 2021). According to Cranefield and Pries-Heje (2020), from the government's viewpoint, it is perceived as a method to stabilize the presentation of public help and productivity and is likewise essential to the achievement of Smart City designs where transparent and residential association is a key necessity (Gil et al., 2019). Networked smart city governance city versus a non-smart city base is however information systems supporting smart city governance.

**2.4 Agile governance as a potential solution**

The challenge of implementing smart cities can be overcome by agile governance. Applying agile principles which include collaboration, iteration, feedback, and value to the customer, can make local government more adaptative, responsive, and result-oriented (Highsmith, 2018). The development of smart cities, therefore, can achieve greater collaboration with the government, the private sector, and society, with agile governance (Sharma et al., 2023). When many different stakeholders are involved from the beginning, agile governance can make sure that the solutions that are developed match the needs and hopes of society (Ommeren & Bekkers, 2022). Local governments can, with the help of agile governance, also manage risks and uncertainties in smart city development. Such an approach allows local governments to use an iterative and incremental approach in experimenting with new solutions on a small scale, before making them available on a broader scale (Viitanen, 2022). By doing that, it can lower the risk of project failure and ensure that investments made give the best possible results.

Several studies indicate the advantages of agile governance in smart city development, in particular. In South Korea, agile governance is found to make smart city projects more efficient and effective (Lee & Kwak, 2022). Accordingly, Sharma et al. (2023) find that agile governance can help in collaboration between government, private sector, and society to develop smart cities in India. Agile governance has been effective in Amsterdam in helping city governments quickly adapt to change and come up with innovative solutions about how to build houses, for example (Klievink & Janssen, 2020). A case study in Mexico City demonstrates how agile governance can improve transparency and accountability in the implementation of smart cities.

**2.5 Smart City and Agile Governance**

In the current digital era, the smart city concept has become a new paradigm in urban development providing rich innovation. As a result of rapid advances in information and communications technology (ICT), smart cities deliver innovative solutions to respond to numerous complex urban challenges, from congestion and pollution to social inequality (Komninos et al., 2018). In essence, smart cities utilize the latest technologies, but their real value comes from the conjunction of technologies and the city’s good governance that makes the city a better place to live for its inhabitants (Albino et al., 2019). But, the journey to a smart city has its hurdles. Local governments face the challenge of an increasingly complex task of solving urban problems with limited resources, in an environment of growing socio-political and technological dynamics (Hollander, 2018). Further, smart city development frequently suffers from the risk of a rigid and less adaptive top-down approach hampering development (Iannacci & Lazzeroni, 2019). We argue that agile governance constitutes a promising alternative to the governance of smart city development and address how it can address complexity and uncertainty within the systems engineering domain of smart city development.

Agile governance, on the other hand, which originates from the software industry, emphasizes flexibility, adaptability, collaboration, and a focus on customer value (Highsmith, 2018). These principles enable local governments to respond quickly to change, actively involve communities, and optimize resource use (Klievink & Janssen, 2020). Agile governance also encourages innovation and experimentation, which are very important in the sustainable development of smart cities.

Consequently, agile governance can be considered one way to reinforce participatory democracy – creating opportunities for people to articulate their aspirations and needs and participate in the design of solutions that map onto their context.

The development of a smart city is a complex process characterized by uncertainty. Conforto and Salinesi (2020) describes Agile Governance as a flexible and adaptive structure that helps to navigate the complexity and uncertainty within this paradigm. Principles of Agile such as iteration and feedback allow local governments to react quickly to change and adapt as they go. This matches the postulate of complex systems theory which promotes adaptability and resilience in meeting changing and unpredictable environments (Holland, 1995). This theory could be seen as an Agile governance approach since it supports organizations to continuously learn and adapt to new challenges by developing what we have.

While also bringing its potential, however, the implementation of agile governance in the public sector, especially in Indonesia, still has several challenges. Some of the obstacles are lack of understanding about agile, ‘resistance to change’, and ‘limited resources’ (Linders, 2019). However, this research demonstrates that there is a substantial opportunity to create and strengthen the implementation of agile governance in Indonesia. Investment in training and capacity development, coupled with continuous learning and constant adaptation, and ultimately, strong political support, agile governance provides the opportunity for realising a sustainable and inclusive smart city.

**2.6 A Case Study**

**2.6.1 Jogja Smart City Project**

The implementation of the Jogja Smart City project specifically related to the implementation of Virtual City Hall offers a unique opportunity to achieve agile and digital governance principles (Pramudita & Syafiqurrohman, 2024). As such, smart city initiatives like the Virtual City Hall attempt to exploit digital technologies to improve urban service delivery, enhance governance processes and connect with citizens. Agile methodologies integrated into the governance framework of smart city projects can help the local government adapt to variable situations, enhance collaboration among different stakeholders and achieve the smooth design and delivery of services (Faber et al., 2018). In this case, the governance in a smart city needs to be agile which means that decision-making can happen iteratively, flexibly and be adjusted quickly in response to feedback and evolving requirements. However, digital platforms and technologies, including digital twins and e-government platforms, are used to enable citizen participation and participation in smart city projects (Hämäläinen, 2021; Domingo et al., 2021). In addition, in order to implement smart city initiatives such as the Virtual City Hall, digital transformation, data-driven strategies and the readiness of local governments to adopt technology are essential areas of knowledge.

Indeed, the full potential of smart city projects cannot be realised if government officials and citizens are not digitally literate data security is not guaranteed and if the pressing implementation challenges are not dealt with (Fazil et al., 2022). Additionally, smart city governance does not only encompass the technological part but also includes the social and environmental part. Following the sustainable development goals, by supporting citizen-driven approaches, and increasing the resilience of cities, local governments develop inclusive and sustainable smart cities bringing the quality of life of their residents to a new level (Kolesnichenko et al., 2021). Agile and digital approaches to governance stand to be of great benefit to the implementation of the Jogja Smart City project, as implemented through the Virtual City Hall. Local governments can increase service delivery while increasing transparency and building smart cities that can respond to the needs of their communities with the use of digital technologies, citizen engagement, and an agile approach.

According to Baltac (2019), smart city initiatives are reported for digital technologies to be used for improving governance, public services, and urban management. A firm smart city governance framework with support, capacity, and value components is required for successful smart city projects (Nastjuk et al., 2022).

The complexities of smart city governance need to be navigated while taking into account socio-technical facets, as well as public and private stakeholders in the decision-making process. Acceptance and utilization of digital public services are key indicators of trust and the user experience in the smart city project execution. Furthermore, a citizen-centered smart city mobile application promotes digital participation and governance.

**2.6.2 Transparency and Accountability**

To enable stakeholders to understand the magnitude to which they are impacted by a system, a system provider needs to adequately disclose what the system’s objectives were which design strategies were deployed, the probable positive or negative results of the system, the output of the system, how the system was operated and any remedies required among other critical elements (Sanyaolu, et al., 2023). Dasar Jogja Smart Service's presence of certain menus in the Jogja Smart Service application also shows honesty in the service and complies with regulation regulations. The functionality of this application supports the government’s honesty pledge by providing real-time reports and data immune to manipulation. This application perceives the availability of simplified and central data immediately accessible to the public to be a measure of the area to attainment of legal conformity and adherence. The application of this mechanism makes it possible to create an environment in which it is possible to comply with legally established and legislation-relevant responsibilities. It furthermore advocates transparency and the disclosing of statistics. These are in line with the result presented by Fauzi & Setiawan (2020), that JSS is highly appreciated by the community and government institutions. This community is being constantly monitored by the authorities; consequently, there is responsibility for all services and there is a higher amount of transparency in real-time reporting on JSS apps.

Agile management is a novel way to direct the engineering, information and communication technology (ICT) design and implementation and the project activity to develop a new product or service as described by Hong and Kim (2020). One of the core strategies outlined here is a high degree of adaptability and flexibility. A methodology or approach which an entity adopts to organise and control information is known as agile management. After this, this approach is incorporated into Government affairs to produce an agile Government capable of moving fast, flexibly and responsively. The idea is to achieve the kind of hyper-transparency that promotes values or procedures, signals policies and empowers teams to experiment with new approaches or outreach (Mergel, 2016). Mergel et al. (2018) then studied agile methods from the software engineering field. Agile government practice broadened the scope to include a broader range of factors yet the goal is still to shift the organization’s culture and collaboration methods to a greater level of adaptability.

**2.6.3 Appropriate Choices in Terms of Quality and Quantity**

Providing the right choices when it comes to the quality and quantity of its service, Jogja Smart Service is the best. As far as quality is concerned, it supplies the users with accurate information and services. This characteristic is visible in the app’s capability of showing data in real-time, to guarantee that the information shown to customers is true and relevant. The availability of quality choices in terms of quantity is also shown in Jogja Smart Service. The app allows for various service options that cover a vast range of community needs. Users therefore have quite access to a wide range of services available and information through this platform. This availability of appropriate choices is significant in the sense that users can choose and access services based on their own needs and choices. Jogja Smart Service provides an abundant choice, offering high flexibility for the community in enjoying the services they need, this application is a solution comprehensive and effective to support various aspects of the life of the community.

Based on the study conducted by Onwujekwe and Weistroffer (2019) the benefits of Agile Government can be seen in the results of different projects. Based on the results of this study, it is suggested that an agile methodology for information systems development in government or public sector organizations is paramount, but is challenging in the face of the bureaucratic nature of those organizations. A case study shows that as stated by Wen et al. (2020), Agile Government has some advantages. Agile and FLOSS practices coupled with collaborative development technologies are used to create software which can be readily updated and replicated in different government sectors, they argue. Moreover, the structure of management used within Agile Government can be applied to future government and academic collaborations as a model.

**3.0** **METHODOLOGY**

Rigorously collecting, evaluating and synthesizing the literature on smart city project management with an emphasis on agile governance frameworks and sustainable public infrastructure was conducted in this study using a desk review methodology. The methodology is based on a structured protocol that guarantees transparency, replicability, and comprehensiveness of identification of relevant academic literature and credible online materials.

A search strategy, using keywords such as smart city, project management, agile governance, agile framework, smart city governance, was developed to comprehensively capture peer-reviewed and grey literature sources. These were searched in the following digital repositories and databases:

Academic Databases (Scopus, Web of Science, IEEE Xplore, SpringerLink and ScienceDirect);

Google Scholar, UN-Habitat reports, World Bank smart city publications, municipal government portals, etc. were grey literature sources.

Key themes were generated from the reviewed journals and materials.

**4.0 RESULTS AND DISCUSSIONS**

**4.1 Smart Cities Governance**

Urban development of recent times is the smart cities. Other forms of city development differ from traditional city development in construction methodology, operational approach and service impact (Shi and Cao, 2022). Liu and Yang (2022) view smart cities as sensor-equipped infrastructure, autonomous vehicles and AI-based services for a better life and efficiency of an urban environment with the images of seamless integration of technology into the urban landscape. However, a smart city is more than just technology (Gracias et al., 2023), it is smart city governance, a holistic approach to how technology, policy and citizen engagement can work together to achieve sustainable urban development.

Smart city governance therefore refers to the forms, regulations and procedures that use modern technologies to improve the management of urban areas (Alshwaheen, 2022). An adaptive sustainable smart city framework consists of technology, good governance, environmental consideration and citizens (Mpfumira et al., 2024). Smart city governance means utilizing Information and Communication Technologies (ICTs) to enhance government services, providing information to the public and boosting efficiency – particularly of relevance in the context of the increasing urban populace and the demand for efficient public services (Raghava Rao & Kumar, 2022). These cities use ICT to promote sustainability by optimum resource management and by reducing environmental footprints (Mrabet & Sliti, 2024).

**4.2 ICT Governance for Effective Smart City Governance**

ICT is one of the important foundational, basic components for all smart cities (Pereira et al., 2018). Hence, ICT governance becomes an aspect that should be considered when governing a smart city. Planned, coordinated and enabled utilization of urban technologies, urban data and urban technologies as means of communication for urban coordination also entails a redesign of urban governance and organization (Batty et al, 2012). It includes policies related to human capital, political and economic development, and governance activities, all of which depend on how ICT can be improved to implement the policies (Kitchin, 2013). The imperativeness of smart cities is because they are necessitated by implementation levels of ICT and smart governance to effect better performance in service delivery (Ncamphalala & Vyas-Doorgapersad, 2022). Good governance interlaces with the digital transformation of the ICT process as a smart city governance paradigm of more urban quality of life, rethinking urban ICT systems, competent human resources and enhancing the urban city resilience in a digital era (Sukmadiansyah dan Noviaristanti, 2022).

ICT can also lead to smarter governance (city government performing its functions more efficiently and effectively) (Pereira et al., 2017). Moreover, the fact that data, information, and communication technologies as well as urban governance are everywhere in discussions on smart cities (Odefadehan, 2021), buttresses the fact that ICT is very central to smart governance. This is the delivery of smart services by the smart cities to the residents which are integrated into governance for development, as an integrated whole (Fatewar & Vaishali, 2021), through effective usage, for instance, of the Internet of Things (IoT), artificial intelligence or machine learning. This is further presented by Fauzi et al. (2020) where utilization of ICT was used as the biggest dominating factor for smart city governance applications.

Besides facing these challenges, the use of ICT infrastructure in the overall smart city concept often comes with other ICT infrastructure use as it can be used in non-smart ways of monitoring, management and decision-making tools (Yandri et al., 2020). In the case of smart city, investment of human and social capital, traditional and modern communication, infrastructure, as well as participatory governance continue to be stressed (AlAwadhi et al., 2012). The smart cities' observation and integration of the status of the infrastructures management, governance, people and communities, as well as natural environments is carried out through ICT (Kumar, 2019). The smart city vision includes merging the city’s physical and digital layers and integrating them fully into the city and ICT is key to that vision (Kramers et al., 2016).

**4.3 Smart City Governance: Agile Framework for Sustainable Public Infrastructure Initiatives**

This section explains the designed agile governance framework for sustainable public infrastructure initiatives. This framework integrates different dimensions of growing a smart city. This is a new approach to establishing sustainable smart cities. The integrated dimensions include smart living, sustainability, smart economy, humanism, smart government, resource management, citizen and society participation, market orientation, and institutional and digital dimensions. The inputs and contributions from the various dimensions will consequently help in the management of smart city projects.

**HUMANIST**

**RESOURCE MANAGEMENT**

**MARKET ORIENTATION**

**SMART ECONOMY**

**DIGITAL**

**SMART LIVING**

**SMART GOVERNMENT**

**CITIZEN & SOCIETY**

**SUSTAINABILITY**

**INSTITUTION**

**Figure 1:** A Designed Agile Governance Framework - *adapted from Cohen’s Smart City Wheel (Cohen, 2014)*

**4.3.1 Smart Living Dimension**

A smart city is mingled with smart living which involves the application of information and communication technologies to improve the quality of life and well-being of people living in urban areas. The smart city, from the smart homes and housing to the sustainable urban environment up to the technological input in making work easier for the human. Other dimensions of a smart city further include smart mobility, smart environment, smart citizens, smart government and smart architecture (Ismagilova et al., 2019). An integrated ICT means an integrated ICT that integrates everyday things at home and other environments for smart living. Smart living is called smart life in the sense that it can be used to improve quality of life and sustainable urban living by the application of technology (Lee et al. 2011). One thing is clear and that is what the human needs should improve with the introduction of smart living technology, it should improve the quality of life for the human being and also sustain the environment for future generations (Lee et al., 2011).

**4.3.2 Sustainability Dimension**

An intense need is considered for transformation of the cities into smart cities, to realize sustainable development goals and to decisively overcome urban and environmental problems, especially in developing countries (Janik et al., 2019). Since then, smart cities have supported the concept of an environmental sustainability agenda, for example, the use of technologies, monitoring of resource consumption like water supply and current city transformation to the system of a sustainable urban system (Angelidou et al. 2017). To mop up the potential threat to the smart cities' ecology of incongruence between smart cities' policies and the carbon dioxide emissions (Bibri et al., 2023), extraction of resources and the production process toxic and energy needs of the data farms (Kuntsman, 2020), sustainability needs to be integrated into smart city governance. These challenges necessitate that the development of smart city governance frameworks should adopt, and address them carefully and consequently contribute effectively to environmental sustainability.

**4.3.3 The Humanist Dimension**

However, when talking about smart city development it must be emphasized that the digital and technological aspects thereof should not be ignored, with people (and their humanist implications) rightfully playing a role in the mix. Smart cities offer a humanist approach to the design of urban environments that build positive value for citizens in their lives. This facet also importantly informs the identification and alleviation of some negative facets of modern urban living, homelessness, and climate anxiety. Philosophical humanism, ecological ethics, and sociocultural approaches are introduced as these aspects delineate how sustainability and livability are important (Xu et al., 2022). The more technologically oriented communications development initiatives in Smart city initiatives need to emphasize the human-centric nature (AlAwadhi et al., 2012). Sustainable development and prosperity of urban areas rely on the use of human, collective, and technological capital and are based on this concept of smart cities (Alverti et al., 2020). It would not be a smart city without the technological part and without the human dimension, it would not be a smart city.

**4.3.4 Resource Management Dimension**

The challenge with limited resources exists in every city. A Smart City is one which utilizes its ICT to integrate resource management including critical resources properly and limitlessly to enhance efficiency and effectivity of use and to also ensure equitable allocation across the large number of initiatives that are undertaken. For example, concerning water resources, smart cities use technology, for example, the Internet of Things and machine learning to efficiently capture and manage the resources while working towards building a sensitive city by having a well-defined vision (Gușul & Butnariu, 2021; Šulyová & Kubina, 2022). Additionally, a Smart City can monitor and operate certain essential infrastructure functionality, control maintenance activity, and optimize resource usage while maintaining security (Joshi et al., 2016). The good examples of managing critical water resources are Sponge Cities. A more resource-efficient management and economy runs a smart city than an ordinary city, through the application of current methods of information technology to facilitate smart response to various public service needs, social management, and industrial operations (Impedovo and Pirlo, 2020). As they integrate into many parts of a city’s infrastructure, they are also resources for a city to effectively and environmentally sound housing initiatives. Smart city development makes managing energy a key element; that is, energizing smart cities as much as possible with energy resources while ensuring their sustainability and self-reliability (Rajendiran, 2022).

**4.3.5 Smart Economy Dimension**

The smart economy under the smart cities promotes the encouraged development of e-business, e-commerce and new entrepreneurial opportunities. They realize or become conscious of the fact that the broadband economy is something that has to be actualized; there are steps that have to be taken to achieve vigorous economic development. Earlier stated a smart city depends on ICT to improve service quality, strengthen control over public resources and focus on comfort, maintenance and sustainability. The other aspect is the smart economy dimension of smart cities which refers to managing economic growth, participatory approaches to innovation and promotion of competitiveness, including stimulation of new businesses. As one of the key dimensions to assessing smart cities and accommodating the competitiveness of small and medium-sized enterprises in the city, the smart economy is examined (Ali & Nencioni, 2021; Youssef & Hajek, 2021). Intelligent city economies equally depend on ecosystems that can catalyze start-up businesses and data management.

**4.3.6 Smart Government Dimension**

The success of smart cities requires smart government, a concept that nurtures sustainable urban development, encourages social participation, and inclines the local communities toward taking up decision-making processes. The platform promotes collaboration and co-creation among various stakeholders and supports using technology for sustainable urban development and climate change adaptation.

The role of smart government in a smart city is how it develops and fosters such data ecosystems that interweave ICT across all of the dimensions of a city. That is, it contributes to sustainable urban development and engages local communities in the decision-making processes (Szarek-Iwaniuk & Senetra, 2020). Urban human resource management is viewed as a governance capability brought together from urban historical context, resource characteristics, facility layout, city sustainability, and service innovation (Lyu et al., 2022). The importance of smart government is to improve good governance and create collaboration between the local government organs, private parties, and community groups so that this collaboration becomes an important one for smart city programs’ success (Triyanto et al., 2022).

**4.3.7 Citizen and Society Participation Dimension**

Consequently, citizen involvement begins to form a foundation of smart city governance and its benefits for enhancing democratic process, transparency, and citizen-based urban development (Bartenberger & Grubmüller, 2014). This means citizen involvement in smart cities is the involvement of citizens in the governance and management of the city, e-democracy, and active user involvement this work is supported by (Domingo et al., 2021). Involvement of the citizens is important for smart city initiatives to be successful because it lets cities be more citizen-centered towards urban innovation, increases the legitimacy and justice of governance processes (Soomro et al., 2017), and finally increases the quality of life (Kusumastuti & Rouli, 2021). The structure of smart city infrastructure driven by citizens’ collaboration within the governance process highlights the significance of citizens’ involvement in, in addition to two-way communication between the government and citizens as smart cities leverage new technologies to increasingly promote this dialogue via, online public consultations, discussions, Petitions (Ngo & Le, 2021; Park & Fujii, 2023). This happens also inside the city, in the form of co-creation activities, where citizens are no longer only passive consumers of city planners’ initiatives, but are actively involved themselves. The result is pride and ownership of these initiatives.

**4.3.8 Institutional Dimension**

In establishing effective connections between people and ICTs in smart cities, important institutional factors such as governance, regulations, and policy are likely to be vital factors for smart cities to offer services (Tan & Taeihagh, 2020). Designing and running a smart city requires active cooperation in a harmonious way among people, technologies government, and policy (Nam & Pardo, 2011). Smart cities are state-run, and therefore any paucity of these factors might cause issues. Governments have always had a challenge integrating new policies (Al Hinai et al., 2022).

In the case of smart cities, therefore, since technologies are by nature unpredictable and normally embedded, there is a risk that wrong policies will be brought in on that foundation (Sissons & Thompson, 2012). Also, making systems whose modes of governance are more effective in such cities creates tensions and threats as the citizens resist efforts at stifling rights to privacy, freedom of expression and confidentiality. Therefore, in addition to framing projects within a multi-stakeholder, municipally based partnership (Monzon, 2015), better coordination is required between different sectors by breaking down silos and joining different sectors (Centre for Cities, 2014).

**4.3.9 Digital: Real-time Analytics**

Digital platforms provide seamless modes of interactions between city administrators, stakeholders and citizens for the formation of transparent and collaborative urban governance. For instance, real-time traffic management systems help to increase public health outcomes and reduce congestion and digital health monitoring systems help to reduce congestion and improve public health outcomes (Secinaro et al, 2022). In addition, open data policies implemented in platforms enable the participation of citizens in accessing and forming part of urban planning processes hence having their voice heard in the development of policy and its implementation. Innovations in this regard transform smart city governance to be a technological endeavour as well as a people-centered initiative to create just equitable and sustainable urban environments.

Smart cities will only be effective if they are able to integrate ownership from the communities within them and concurrently provide real-time, inclusive decision-making. Disengagement from community activities as an additional activity in democratic and sustainable urban management neither is (Arnstein, 2019). Including multiple voices helps city planners guarantee that the policies and initiatives embody what all the citizens need and desire—especially the strangers whose perspectives are absent from regular governance arrangements. In this context, digital platforms, notably online forums, mobile applications, and even social media channels act as vehicles that offer accessible and user-friendly platforms for participation (Dawodu et al., 2021).

Smart city governance also entails making real-time decisions. Urban challenges, including traffic congestion, air pollution, and emergency response, are dynamic challenges and need rapid and data-driven solutions (Sarker, 2022). City officials are empowered to respond proactively to emerging issues thanks to digital platforms with real-time analytics and predictive modelling (Adaji et al., 2025). For example, when a natural disaster occurs, it requires the deployment of resources in affected areas quickly and to minimise loss, sensors, and data feeds can instantly provide information about affected areas. Likewise, real-time air quality monitoring can trigger timely actions to minimize polluting impacts, and shield public health (Ma et al., 2019).

**4.3.10 Market Orientation Dimension**

An organizational philosophy gives the customer precedence in judging the company and its products to meet certain customer needs (Avlonitis & Gounaris, 1999). In addition, it includes promoting marketing into the leading corporate culture, employing the entire organization to meet the customer demands, not depending on the company perception and belief to satisfy the customer demands (Avlonitis & Gounaris, 1999). For a smart city, market orientation represents a program of action whereby city planners and developers prioritize the understanding and fulfilment of residents’ and other stakeholders’ needs and preferences as they pertain to the city (Starc-Peceny et al., 2017). Essentially a widespread problem we see in city planning is the discounting of the contribution of marketers to the detriment of engineers and city planners (Starc-Peceny et al., 2017). A market orientation for a smart city means changing roles — the city planners should start to engage citizens and other key players, from the very beginning of the planning process. In this approach, they seek their feedback, involve the community and customize community initiatives based on what its members want. Market insights with customer feedback provide projects that align better with community needs leading to more efficient and effective sustainable initiatives (Alt et al., 2019).

Market-oriented smart cities can foster a more inclusive, responsive, and sustainable urban environment, using technology to do so, but keeping the human in the centre of urban development (Maček et al., 2019; Zhao et al., 2021). Furthermore, marketing can help intercept citizens' needs, as well as play a decisive role in mitigating resistance to change, putting efforts into communicating the new sustainable initiatives to the community so that new sustainable initiatives are met (Huertas et al., 2021).

**4.4 Key Components of the Framework**

Essentially, agile governance reiterates the principles of flexibility, adaptability, data-driven decision-making, collaboration, and a value focus to deliver to the citizenry. Therefore, it allows city governments to dynamically respond to changes in technological aspects as well as urban challenges and drives sustainable outcomes by integrating planning and active public participation (Herawati et al., 2025).

**1. Strategic Vision and Multi‐Dimensional Planning**

It must have a clear, long-term strategic vision aligned with sustainability goals. Infrastructures should be developed and the smart city initiatives guided by the vision in economic, social and technological, as well as environmental dimensions (Herawati et al., 2025).

**2. Collaborative Governance processes breeze the bureaucratic hurdles in the most uninterrupted manner**

Collaboration, leadership, and partnership across multiple sectors and government levels are necessary for effective governance. Successful implementation of those processes, like communication, service integration, data exchange, and participation is fundamental (Silvia, 2011).

**3. Technology and Data Governance**

Technology and Data Governance are two evolving terms that entail data usage policies and their mechanisms along with technology support to ensure that these policies and standards are effective, followed, and acted upon (OECD, 2023a).

Valid governance of smart city frameworks depends on the rightful governance of data, interoperability standards, and security. Usage of technology like AI, IoT, and blockchain provides transparency, efficiency, and resilience in infrastructure management (OECD, 2023b; Hardi et al., 2025).

**4. Regulatory and Institutional Enablers**

Adaptive regulatory frameworks which support innovation and accountability and are sustainable, are the necessary components to make agile governance work. Both expensive and complex infrastructure projects require institutional capacity to manage the projects as well as sustainable financing mechanisms (Awuzie & Monyane, 2020).

**5. Citizen engagement and Inclusivity**

Legitimacy and effectiveness are predicated on active citizen participation and inclusivity. User-centric approaches that include public feedback and social equity should be supported by governance frameworks (Herawati et al. 2025; Hardi et al. 2025).

**4.5 Key Challenges Associated with Building Smart City Projects**

**Lack of Suitable Infrastructure:** Smart cities need physical infrastructure (sensors, poles, cameras) and solid IT infrastructure for data collection, processing and analysis. As important as new technologies can be for cities, the high costs and increasing complexity of installing and maintaining IoT sensors and high-speed internet access are challenges that many cities struggle with and their ageing infrastructure does not help. The infrastructure needs to be scalable and flexible for growth and technology advancements (Giffinger et al., 2007; Al Nuaimi et al., 2015).

**Security, Transparency and Data Privacy:** Protection of citizens’ data and being transparent in how data is being collected and used is a very critical challenge. Smart technology causes privacy and cybersecurity risks which poses a hurdle to its adoption (Kitchin, 2016; Zanella et al., 2014).

**Effective Coordination Between Public and Private Sectors:** Since it is important but challenging to have a connection between governmental entities and private businesses, project implementation and innovation rely on it (Obasa & Oluyomi, 2024; Danfulani & Gulseven, 2024).

**Political Differences:** Smart city projects need long-term funding and political support, but political differences and lack of willingness or politics will change and priorities change, which can disrupt projects by delay or projects are shut down (Akgun et al., 2024; Tan & Taeihagh, 2020).

**Incapacity and lack of skills:** Many city administrators and citizens lack technical knowledge and skills to take care of, use and manage smart city technologies. Success will require citizen education and citizen engagement as 'smart citizens' (Mancherster & Cope, 2019; Preston et al., 2020).

**Social inclusivity:** Smart city initiatives need to be conceived to help all the segments of the population and not aggravate social inequalities (Kolotouchkina et al., 2024; UN-Habitat, 2025).

**Funding issues:** High initial investment and ongoing funding for smart city projects can be too much of a load, often acting as a barrier. We often need public-private partnerships but they are hard to manage (Tan & Taeihagh, 2020; Almarri & Boussabaine, 2023).

**Complexity in Decision making and Vision Alignment:** Clear priorities, measurable objectives and an aligned vision to steer the smart city development needs are extremely difficult to define and articulate among stakeholders which are needed as a foundation to provide the momentum that will prove that investments made in the development of a smart city were worth it and there is progress towards those objects (Reichental, 2021; Wiecher et al., 2022; Lee et al., 2014).

**Technological Challenges:** Advanced technologies such as AI, IoT and big data analytics are not broadly known and need to be adapted in context to traditional urban infrastructure project management approaches (Ishaq & Farooq, 2023; Wang et al., 2022).

**4.6 Challenges in Implementing Governance Frameworks in Smart Cities**

Although smart city governance frameworks might provide substantial value, their implementation is obstructed by a variety of technological, economic, social and institutional barriers. The biggest challenge here is the digital divide which means unequal access to technology by various demographics. In low-income areas and marginalized communities, do not have the infrastructure or digital literacy to be part of technology-driven governance. In this reality, there stands a high risk of increasing pre-existing inequalities and even compromising the inclusiveness of smart city initiatives (Fang et al., 2019).

There are also utmost important data privacy and security issues. The data collected via IoT devices and digital platforms are very prone to breaches, misuse, surveillance and whatnot. The trick is balancing real-time data and the need to protect individual privacy. To this end, governments must carry out robust cybersecurity measures and legislation to ensure the ethical use of data (Reddick et al., 2020). Not only can smart city technologies effectively serve a city to improve its services, but there is a possibility that their adoption can be constrained by economic constraints.

Building and upkeep of advanced infrastructure can be a capital-intensive affair which can be difficult for cities without a lot of money. In addition, private-sector partnerships may be overly relied on to the detriment of conflicts of interest and public accountability (Mikhaylov et al., 2018). Challenges in institutions include non-standardization and non-coordination across different departments and government agencies. For example, smart city initiatives tend to involve cross-sector collaboration but can be stymied by siloed operations (and all the costs and inefficiencies that bureaucratic systems breed).

Furthermore, the pace of technological advancement may be so quick that present governance institutions cannot change to ably regulate the process of advancement. A second obstacle is social resistance, where citizens may oppose smart city projects because these venture to subvert entrenched systems and processes or because these are seen as being in the interest of elites. Overcoming such resistance is essential for building trust in and for ensuring that benefits are equitably distributed to all, users of the health system (Broccardo et al., 2019).

The role of key stakeholders in any area in bringing forth desired results is crucial. Integrating agile framework will help solve issues created by lack of cohesion among the key stakeholders. Study by Bello et al. (2025) emphasized that agile frameworks contribute to ‘increased’ stakeholder collaboration as they encompass ‘the inclusion’ adaptive planning when fast-changing plans and needs arise.

**5.0 CONCLUSION**

Smart city initiatives provide an important transformation in the governance, development, and sustainability of urban areas. Smart city projects are complex, multi-stakeholder, and technologically intensive and therefore require innovative project management and governance. Traditionally, as revealed by literature, project management frameworks have proved deficient in meeting the dynamic connectedness and continuum of needs of smart cities in terms of sustainability, stakeholder alignment, and rapid adaptation.

The key aim of the review was to demonstrate the relevance of agile governance, comprising flexibility, continuous feedback, cross-sector collaboration, and iterative development, as a robust framework that can be used to manage smart city projects around the globe. Introducing agile principles into public infrastructure planning and execution by city administrators and stakeholders helps to respond more appropriately to technological changes, citizen needs, and environmental challenges.

**6.0 RECOMMENDATIONS**

Building on the analysis and evidence, we propose the following key recommendations to guide action by policymakers, urban planners, and project managers heading smart city development.

**Making Agile Governance Routine:** Enforce agile governance principles among public infrastructure agencies to strengthen their ability to respond, earn trust and adapt projects over time.

**Form Multidisciplinary and Cross-Sectored Hubs:** Set up bodies with government officials, business people, educators, and citizen groups to design and supervise all smart city projects together.

**Pay attention to Digital Infrastructure:** Build systems, like flexible online platforms linked with storage and cybersecurity that enable flexible and data-centered administration. In addition, hire and train employees who specialize in agile practices, technology, and sustainable development.

**Reduce risk:** Test out new initiatives in small settings and collect input quickly so the results can be adapted before spreading them wider. The goal of this approach is to reduce risk, save resources and drive innovation.

**Transparency:** Use transparent data sources and encourage people’s involvement by involving them in decisions. It helps earn people’s trust and keeps projects focused on things that matter to them.

**Chart Clear Policies that Promote Flow:** Review and update your rules and contracts so changes can be made quickly, keeping things flexible for agencies and employees and supporting innovation.

**Ethical Standards**

The review does not involve contact with humans.

**References**

Adaji, C. C., Bello, A. A., Ukatu, C. E., Okika, N., Agboola, O. K., & Amomo, C. G. (2025). AI-Powered Cybersecurity Governance: The Role of Business Analysts in Ethical AI Deployment. *International Journal of Innovative Science and Research Technology, 10* (3). https://doi.org/10.38124/ijisrt/25mar924

Akgün, E. Z., Gerli, P., Mora, L., & McTigue, C. (2024). Breaking barriers for breaking ground: A categorisation of public sector challenges to smart city project implementation. *Environment and Planning C: Politics and Space*. <https://doi.org/10.1177/09520767241263233>

Al Nuaimi, E., Al Neyadi, H., Mohamed, N., & Al-Jaroodi, J. (2015). Applications of big data to smart cities. Journal of Internet Services and Applications, 6(1), 25. <https://doi.org/10.1186/s13174-015-0041-5>

Alawadhi, S., Aldama-Nalda, A., Chourabi, H., Gil-Garcia, J. R., Leung, S., Mellouli, S., ... & Walker, S. (2012). Building understanding of smart city initiatives. In *Electronic Government: 11th IFIP WG 8.5 International Conference, EGOV 2012, Kristiansand, Norway, September 3-6, 2012. Proceedings 11* (pp. 40-53). Springer Berlin Heidelberg.

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of urban technology*, *22*(1), 3-21.

Al-Hinai, Z., Heathcote, J., & Kazemi, H. (2022). Challenges of Projects Supporting Smart Cities’ Development. In *Climate Emergency–Managing, Building, and Delivering the Sustainable Development Goals: Selected Proceedings from the International Conference of Sustainable Ecological Engineering Design for Society (SEEDS) 2020* (pp. 371-383). Springer International Publishing.

Ali, G., & Nencioni, G. (2021). The role of 5G technologies in a smart city: The case for intelligent transportation system. *Sustainability, 13*(9), 5188. https://doi. org/10.3390/su13095188

Alim, S., & Polak, J. (2016). Public–private partnerships for future urban infrastructure. *Proceedings of the Institution of Civil Engineers-Management, Procurement and Law*, *169*(4), 150-158.

Almarri, K., & Boussabaine, H. (2023). Critical success factors for public–private partnerships in smart city infrastructure projects. *Construction Innovation*. <https://doi.org/10.1108/CI-04-2022-0072>

Alshwaheen, G. I. A. L. (2022). Urban model of city planning smart cities. Int. J. Sci. Res. Publ. 12, 365–367. doi: 10.29322/IJSRP.12.09.2022.p12947

Alt, R., Demirkan, H., Ehmke, J. F., Moen, A., & Winter, A. (2019). Smart services: The move to customer orientation. *Electronic Markets, 29*, 1–6. https://doi. org/10.1007/s12525-019-00338-x

Alverti, M., Themistocleous, K., Kyriakidis, P., & Hadjimitsis, D. (2020). A study of the interaction of human smart characteristics with demographic dynamics and built environment: The case of Limassol, Cyprus. *Smart Cities, 3*(1), 48–73. https://doi. org/10.3390/smartcities3010004

Angelidou, M., Psaltoglou, A., Komninos, N., Kakderi, C., Tsarchopoulos, P., & Panori, A. (2017). Enhancing sustainable urban development through smart city applications. *Journal of Science and Technology Policy Management, 9*(2), 146–169. <https://doi.org/10.1108/jstpm-05-2017-0016>

Anthopoulos, L., & Fitsilis, P. (2014, February). Exploring architectural and organizational features in smart cities. In *16th international conference on advanced communication technology* (pp. 190-195). IEEE.

Arnstein, S. R. (2019). A ladder of citizen participation. *Journal of the American planning association*, *85*(1), 24-34.

Avlonitis, G. J., & Gounaris, S. P. (1999). Market orientation and its determinants: An empirical analysis. *European Journal of Marketing, 33*(11/12), 1003–1037. <https://doi.org/10.1108/03090569910285896>

Awuzie, B., & Monyane, T. G. (2020). Conceptualizing sustainability governance implementation for infrastructure delivery systems in developing countries: Success factors. *Sustainability*, *12*(3), 961.

Babić, A., Sokolić, D., & Antonić, J. (2022). Development of smart governance in Croatian cities – the size of a city as a determinant of smart governance. *Ekonomski Vjesnik, 35*(2), 315–335. <https://doi.org/10.51680/ev.35.2.7>

Baltac, V. (2019). Smart cities—A view of societal aspects. *Smart Cities*, *2*(4), 538-548.

Bartenberger, M., & Grubmüller, V. (2014). The enabling effects of open government data on collaborative governance in smart city contexts. *Jedem – E-journal of E-democracy and Open Government, 6*(1), 36–48. <https://doi.org/10.29379/jedem.v6i1.289>

Batty, M., Axhausen, K., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G., & Portugali, Y. (2012). Smart cities of the future. *The European Physical Journal Special Topics, 214*(1), 481–518. https://doi.org/10.1140/epjst/ e2012-01703-3

Bello, A. A., Fakeyede, M., Gold, O., Eshun, N. V., Akibor, J., & Owusu, N. F. (2025). Optimizing agile collaboration frameworks for carbon-efficient digital twin deployment in oil and gas: Strategies, tools, and challenges in the planning phase. *Global Journal of Engineering and Technology Advances*, *22*(02), 034-045.

Bibri, S., Alahi, A., Sharifi, A., & Krogstie, J. (2023). Environmentally sustainable smart cities and their converging AI, IoT, and big data technologies and solutions: An integrated approach to an extensive literature review. *Energy Informatics, 6*(1). <https://doi.org/10.1186/s42162-023-00259-2>

Broccardo, L., Culasso, F., & Mauro, S. G. (2019). Smart city governance: exploring the institutional work of multiple actors towards collaboration. *International Journal of Public Sector Management*, *32*(4), 367-387.

Centre for Cities (2014). Smart Cities - Centre for Cities. [Online]. Last accessed on 6 January 2018 at: <http://www.centreforcities.org/publication/smart-cities/>

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., ... & Scholl, H. J. (2012). Understanding smart cities: An integrative framework. In *2012 45th Hawaii international conference on system sciences* (pp. 2289-2297). IEEE.

Cocchia, A. (2014). Smart and digital city: A systematic literature review. *Smart city: How to create public and economic value with high technology in urban space*, 13-43.

Conforto E., & Salinesi C. (2020). Agile governance: a research roadmap. In Proceedings of the 18th International Conference on Agile Software Development (XP 2020). 1-12.

Cranefield, J., & Pries-Heje, J. (2020). Moving beyond showcasing: The five faces of leadership in smart city transformation. <https://doi.org/10.26686/wgtn.12910076>

Curwell, S., Deakin, M., Cooper, I., Paskaleva-Shapira, K., Ravetz, J., & Babicki, D. (2005). Citizens' expectations of information cities: implications for urban planning and design. *Building Research & Information*, *33*(1), 55-66.

Danfulani, W. A., & Gülseven, E. (2024). Economic Community of West African States (ECOWAS) public–private partnership (PPP) strategy to development. *Social Sciences, 13*(10), 531. <https://doi.org/10.3390/socsci13100531>

Dawodu, A., Sharifi, A., Cheshmehzangi, A., & Oladejo, J. (2021). The illusion of participation: Are participatory indicators truly effective in neigborhood sustainability assessment tools. *Journal of Cleaner Production*, *311*, 127538.

Domingo, J., Cabello, K. A., Rufino, G. A., Hilario, L., Villanueva-Jerez, M. J., & Sarmiento, C. J. (2021). A framework in developing a citizen-centered smart city mobile application as a platform for digital participation in Iloilo city. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *46*, 153-160.

Faber, A., Rehm, S. V., Hernandez-Mendez, A., & Matthes, F. (2018). Modeling and visualizing smart city mobility business ecosystems: insights from a case study. *Information*, *9*(11), 270.

Fang, M. L., Canham, S. L., Battersby, L., Sixsmith, J., Wada, M., & Sixsmith, A. (2019). Exploring privilege in the digital divide: implications for theory, policy, and practice. *The Gerontologist*, *59*(1), e1-e15.

Fatewar, M., & Vaishali. (2021). COVID-19: An opportunity for smart and sustainable cities in India. In *The Impact of the COVID-19 Pandemic on Green Societies: Environmental Sustainability* (pp. 1-30). Cham: Springer International Publishing. https:// doi.org/10.1007/978-3-030-66490-9\_1

Fauzi, E. A., & Setiawan, A. (2019). Accountability Jogya Smart Service Application in Public Sector Services in Yogyakarta 2019. In *International Conference on Public Organization (ICONPO)*.

Fauzi, E. A., Nurmandi, A., & Pribadi, U. (2020). A Literature Review on Smart City and Smart Governance. *JPPUMA J. Government Science. and Sauce. Polit. UMA (Journal Gov. Polit. Soc. UMA)*, *8*(1), 84-89. https://doi. org/10.31289/jppuma.v8i1.3304

Fazil, M., Fahmi, A., & Riski, A. (2022). Digital literacy in building a smart city at banda aceh. *International Journal of Engineering Science and Information Technology, 2*(4), 55-60. <https://doi.org/10.52088/ijesty.v2i4.324>

Frost & Sullivan (2018). Experts Announce Global Smart Cities to Raise a Market of Over $2 Trillion by 2025. https://ww2.frost.com/news/press-releases/frost-sullivan experts-announce-global-smart-cities-raise-market-over-2 trillion-2025/

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., & Meijers, E. (2007). Smart cities: Ranking of European medium-sized cities. Centre of Regional Science, Vienna University of Technology. <https://www.smart-cities.eu/download/smart_cities_final_report.pdf>

Gil, O., Cortés-Cediel, M., & Cantador, I. (2019). Citizen participation and the rise of digital media platforms in smart governance and smart cities. *International Journal of E-Planning Research, 8*(1), 19–34. <https://doi.org/10.4018/ijepr.2019010102>

Gracias, J. S., Parnell, G. S., Specking, E., Pohl, E. A., & Buchanan, R. (2023). Smart cities—a structured literature review. *Smart Cities*, *6*(4), 1719-1743.

Gușul, P., & Butnariu, A. (2021). Exploring the relationship between smart city, sus tainable development and innovation as a model for urban economic growth. *The Annals of the University of Oradea Economic Sciences, 30*(1), 82–91. https://doi.org/ 10.47535/1991auoes30(1)007

Hämäläinen, M. (2021). Urban development with dynamic digital twins in Helsinki city. *IET Smart Cities, 3*(4), 201-210. <https://doi.org/10.1049/smc2.12015>

Hardi, R., Nurmandi, A., Purwaningsih, T., & Manaf, H. A. (2025). Smart city governance and interoperability: enhancing human security in Yogyakarta and Makassar, Indonesia. *Frontiers in Political Science*, *7*, 1553177.

Herawati, A. R., Dwimawant, I. H., & Pradana, A. E. (2025). Agile and Dynamic Governance: Driving Smart City Innovations in Indonesia. *KnE Social Sciences*, *10*(4), 340-363.

Highsmith J. (2018). Agile project management: Creating innovative products. 2nd ed. Addison Wesley.

Holland J.H. (1995). Hidden order: How adaptation builds complexity. Addison-Wesley.

Hollander G. (2018). Agile in the city: How to adopt agile in public sector organizations. Boekenplan.

Hong, K. P., & Kim, P. S. (2020). Building an agile government: Its possibilities, challenges, and new tasks. *Halduskultuur*, *21*(1), 4-21.

Huang-Lachmann, J.-T. (2019), “Systematic review of smart cities and climate change adaptation”, Sustainability Accounting, Management and Policy Journal, Vol. 10 No. 4, pp. 745-772.

Huertas, A., Moreno, A., & Pascual, J. (2021). Place branding for smart cities and smart tourism destinations: Do they communicate their smartness? *Sustainability, 13*(19), 10953. <https://doi.org/10.3390/su131910953>

Iannacci F., & Lazzeroni, P. (2019). Agile governance for smart cities: a framework for integrating agile practices into the public sector. *Sustainability, 11*(17): 4648.

Impedovo, D., & Pirlo, G. (2020). Artificial intelligence applications to smart city and smart enterprise. *Applied Sciences, 10*(8), 2944. https://doi.org/10.3390/ app10082944

Ishaq, K., & Farooq, S. S. (2023). Exploring IoT in smart cities: Practices, challenges, and way forward. *arXiv*. <https://arxiv.org/abs/2309.12344>

Ismagilova, E., Hughes, D., Dwivedi, Y., & Raman, K. (2019). Smart cities: Advances in research – an information systems perspective. *International Journal of Information Management, 47*, 88–100. <https://doi.org/10.1016/j.ijinfomgt.2019.01.004>

Janik, A., Ryszko, A., & Szafraniec, M. (2019). Smart and sustainable cities: In search of comprehensive theoretical framework. *Scientific Papers of Silesian University of Technology Organization and Management Series, 9*(6), 109–139. https://doi.org/ 10.29119/1641-3466.2019.140.10

Joshi, S., Saxena, S., & Godbole, T. (2016). Developing smart cities: An integrated framework. *Procedia Computer Science, 93*, 902–909. [https://doi.org/10.1016/j. procs.2016.07.258](https://doi.org/10.1016/j.%20procs.2016.07.258)

Kitchin, R. (2013). The real-time city? big data and smart urbanism. *Geo-journal, 79*(1), 1–14. https://doi.org/10.1007/s10708-013-9516-8

Kitchin, R. (2016). The ethics of smart cities and urban science. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 374*(2083), 20160115. https://doi.org/10.1098/rsta.2016.0115

Klievink B., & Janssen, M. (2020). Agile governance for smart cities: a case study of Amsterdam. *Government Information Quarterly, 37*(2): 101466

Kolesnichenko, O., Mazelis, L., Sotnik, A., Yakovleva, D., Amelkin, S., Grigorevsky, I., … & development Kolesnichenko, Y. (2021). Sociological modeling of smart city with the implementation of UN sustainable goals. *Sustainability Science, 16*(2), 581-599. https://doi.org/10.1007/s11625-020-00889-5

Kolotouchkina, O., Ripoll González, L., & Belabas, W. (2024). Smart cities, digital inequalities, and the challenge of inclusion. *Smart Cities, 7*(6), 130. <https://doi.org/10.3390/smartcities7060130>

Komninos N., Kakderi, C., Mora, L., & Panori, A. (2018). The smart city as an innovation ecosystem. In N. Komninos, C. Kakderi, & L. Mora (Eds.), *Smart city ecosystems. Springer*. 1-22.

Kramers, A., Wangel, J., & Höjer, M. (2016). Governing the smart sustainable city: The case of Stockholm royal seaport. <https://doi.org/10.2991/ict4s-16.2016.12>

Kumar, B. (2019). The (in) security of smart cities: Vulnerabilities, risks, mitigation and prevention. *International Journal of Engineering and Advanced Technology, 8*(5s3), 464–470. <https://doi.org/10.35940/ijeat.e1097.0785s319>

Kuntsman, A. (2020). Smart cities’ environmental dreams and their dirty material politics. AoIR Selected Papers of Internet Research. [https://doi.org/10.5210/spir. v2020i0.11254](https://doi.org/10.5210/spir.%20v2020i0.11254)

Kusumastuti, R., & Rouli, J. (2021). Smart city implementation and citizen engagement in Indonesia. *IOP Conference Series Earth and Environmental Science, 940*(1), 012076. https://doi.org/10.1088/1755-1315/940/1/012076

Lam, P. T., & Yang, W. (2020). Factors influencing the consideration of Public-Private Partnerships (PPP) for smart city projects: Evidence from Hong Kong. *Cities*, *99*, 102606.

Lee J., & Kwak, Y. (2022). Agile governance in smart city projects: a case study of Seoul. *Sustainability, 14*(11), 6611.

Lee, C., Lee, J., Lo, P., Tang, H., Hsiao, W., Liu, J., & Lin, T. (2011). Taiwan perspec tive: Developing smart living technology*. International Journal of Automation and Smart Technology, 1*(1), 93–106. <https://doi.org/10.5875/ausmt.v1i1.74>

Lee, J., Hancock, M. G., & Hu, M. L. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change, 89*, 80–99. <https://doi.org/10.1016/j.techfore.2014.07.028>

Linders B. (2019). The agile government survival guide. Ben Linders Consulting.

Liu, Y., & Yang, K. (2022). Communication, sensing, computing and energy harvesting in smart cities. *IET Smart Cities*, *4*(4), 265-274.

Lyu, J., Hamzah, H., & Tedong, P. (2022). A framework for the analysis of urban inno vation in smart cities: Literature review findings. Planning Malaysia, 20. https:// doi.org/10.21837/pm.v20i24.1188

Ma, M., Preum, S. M., Ahmed, M. Y., Tärneberg, W., Hendawi, A., & Stankovic, J. A. (2019). Data sets, modeling, and decision making in smart cities: A survey. *ACM Transactions on Cyber-Physical Systems*, *4*(2), 1-28.

Maček, A., Ovin, R., & Starc-Peceny, U. (2019). Smart cities marketing and its conceptual grounds. Naše Gospodarstvo/Our Economy, 65(4), 110–116. https://doi. org/10.2478/ngoe-2019-0024

Manchester, H., & Cope, G. (2019). Learning to be a smart citizen. *Oxford Review of Education, 45*(2), 224–241. <https://doi.org/10.1080/03054985.2018.1552582>

Meijer, A., & Bolívar, M. (2015). Governing the smart city: A review of the literature on smart urban governance. *International Review of Administrative Sciences, 82*(2), 392–408. <https://doi.org/10.1177/0020852314564308>

Meijer, A.J, & Bolívar, M.P.R. (2021). Agile governance in smart city projects: a systematic literature review. Cities. 110: 103067.

Mergel, I. (2016). Agile innovation management in government: A research agenda*. Government Information Quarterly, 33*(3), 516–523. <https://doi.org/10.1016/j.giq.2016.07.004>

Mergel, I., Gong, Y., & Bertot, J. (2018). Agile government: Systematic literature review and future research. *Government Information Quarterly*, *35*(2), 291-298.

Mikhaylov, S. J., Esteve, M., & Campion, A. (2018). Artificial intelligence for the public sector: opportunities and challenges of cross-sector collaboration. *Philosophical transactions of the royal society a: mathematical, physical and engineering sciences*, *376*(2128), 20170357.

Monzon, A. (2015). Smart cities concept and challenges: Bases for the assessment of smart city projects. In *2015 international conference on smart cities and green ICT systems (SMARTGREENS)* (pp. 1-11). IEEE.

Mrabet, M., & Sliti, M. (2024). Integrating machine learning for the sustainable development of smart cities. *Frontiers in Sustainable Cities*, *6*, 1449404.

Mukhlis, I., Suwanan, A., Hidayati, B., Roudhotus, S., & Rizaludin, M. (2021). Can the implementation of smart city promote inclusive development of a local economy? <https://doi.org/10.2991/aebmr.k.210213.011>

Mupfumira, P., Mutingi, M., & Sony, M. (2024). Smart city frameworks SWOT analysis: a systematic literature review. *Frontiers in Sustainable Cities*, *6*, 1449983.

Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. In *Proceedings of the 12th annual international digital government research conference: digital government innovation in challenging times* (pp. 282-291).

Nam, T., & Pardo, T. A. (2011, June). Conceptualizing smart city with dimensions of technology, people, and institutions. In *Proceedings of the 12th annual international digital government research conference: digital government innovation in challenging times* (pp. 282-291).

Nastjuk, I., Trang, S., & Papageorgiou, E. I. (2022). Smart cities and smart governance models for future cities: Current research and future directions. *Electronic Markets*, *32*(4), 1917-1924. [https://doi.org/10.1007/s12525-022- 00609-0](https://doi.org/10.1007/s12525-022-%2000609-0)

Ncamphalala, M., & Vyas-Doorgapersad, S. (2022). The role of information and com munication technology (ICT) on the transformation of municipalities into smart cities for improved service delivery. International Journal of Research in Business and Social Science (2147-4478), 11(2), 318–328. [https://doi.org/10.20525/ijrbs. v11i2.1593](https://doi.org/10.20525/ijrbs.%20v11i2.1593)

Ngo, H., & Le, Q. (2021). Smart city: An approach from the view of smart urban governance. *International Journal of Sustainable Construction Engineering Technology, 12*(1). https://doi.org/10.30880/ijscet.2021.12.01.029

Obasa, S. O. O., & Oluyomi, O. O. O. (2024). Public-private partnerships and sustainable development goals in Nigeria. *African Journal of Stability and Development, 16*(2), 390–417. <https://doi.org/10.53982/ajsd.2024.1602.10-j>

Odefadehan, C. (2021). Smart city development, urban governance and affordable housing in Lagos Nigeria. *Caleb Journal of Social and Management Science, 06*(01), 51–69. <https://doi.org/10.26772/cjsms2021060103>

Ojasalo, J., & Kauppinen, H. (2016). Collaborative innovation with external actors: an empirical study on open innovation platforms in smart cities. *Technology Innovation Management Review*, *6*(12), 49-60.

Ommeren, E. V., & Bekkers V. (2022). Agile governance for smart cities: a framework for evaluating the impact of agile practices. *Public Management Review, 24*(3), 393-414.

Onwujekwe, G., & Weistroffer, H. (2019). Agile development in bureaucratic environments: A literature review. In *Information Systems: 15th European, Mediterranean, and Middle Eastern Conference, EMCIS 2018, Limassol, Cyprus, October 4-5, 2018, Proceedings 15* (pp. 316-330). Springer International Publishing.

Organisation for Economic Co-operation and Development (OECD). (2023a). *Data and technology governance: Fostering trust in the use of data*. [https://www.oecd.org/en/publications/oecd-digital-education-outlook-2023\_c74f03de-en/full-report/data-and-technology-governance-fostering-trust-in-the-use-of-data\_171e56b9.htm](https://www.oecd.org/en/publications/oecd-digital-education-outlook-2023_c74f03de-en/full-report/data-and-technology-governance-fostering-trust-in-the-use-of-data_171e56b9.html)

Organisation for Economic Co-operation and Development (OECD). (2023b). *Smart City Data Governance: Challenges and the Way Forward*. OECD Urban Studies. <https://doi.org/10.1787/e57ce301-en>

Park, J., & Fujii, S. (2023). Civic engagement in a citizen-led living lab for smart cities: Evidence from South Korea. *Urban Planning, 8*(2). https://doi.org/10.17645/ up.v8i2.6361

Paskaleva, K. (2018). Agile governance for smart cities: a conceptual framework. In Proceedings of the 15th International Conference on e-Governance (EGOV 2018). 1-10.

Pereira, G., Parycek, P., Falco, E., & Kleinhans, R. (2018). Smart governance in the context of smart cities: A literature review. *Information Polity, 23*(2), 143–162. <https://doi.org/10.3233/ip-170067>

Pramudita, R., & Syafiqurrohman, A. (2024). Implementation of Jogja Smart City: Virtual City Hall in Realizing Agile and Digital Governance. *Agile Governance and Innovation Measurement Journal*, *1*(2), 59-70.

Preston, S., Mazhar, M. U., & Bull, R. (2020). Citizen engagement for co-creating low carbon smart cities: Practical lessons from Nottingham City Council in the UK. *Energies, 13*(24), 6615. <https://doi.org/10.3390/en13246615>

Raghava Rao, K., & Kumar, D. S. (2022). Smart city governance using big data technologies. *Advanced analytics and deep learning models*, 311-324.

Rajendiran, G. (2022). Non-intrusive load monitoring. https://doi.org/10.1145/ 3538637.3539635 Scholl, H., & AlAwadhi, S. (2016). Smart governance as key to multi-jurisdictional smart city initiatives: The case of the e-city gov alliance*. Social Science Information, 55*(2), 255–277. <https://doi.org/10.1177/0539018416629230>

Reddick, C. G., Enriquez, R., Harris, R. J., & Sharma, B. (2020). Determinants of broadband access and affordability: An analysis of a community survey on the digital divide. *Cities*, *106*, 102904.

Reichental, J. (2021). *Smart city pitfalls: No clear vision, inadequate governance*. Cities Today. <https://cities-today.com/industry/smart-city-pitfalls-no-clear-vision-inadequate-governance/>[cities-today.com+1cities-today.com+1](https://cities-today.com/industry/smart-city-pitfalls-no-clear-vision-inadequate-governance/?utm_source=chatgpt.com)

Rodríguez-Abitia G., & Bribiesca-Contreras R. (2019). Agile governance for smart cities: a case study of Mexico City. *Journal of Urban Technology, 26*(3), 63-78.

Sanyaolu, T. O., Adeleke, A. G., Efunniyi, C. P., Akwawa, L. A., & Azubuko, C. F. (2023). Stakeholder management in IT development projects: Balancing expectations and deliverables. *International Journal of Management & Entrepreneurship Research P-ISSN*, 2664-3588.

Sarker, I. H. (2022). Smart City Data Science: Towards data-driven smart cities with open research issues. *Internet of Things*, *19*, 100528.

Secinaro, S., Brescia, V., Iannaci, D., & Jonathan, G. M. (2022). Does citizen involvement feed on digital platforms?. *International Journal of Public Administration*, *45*(9), 708-725.

Sharma, S., Kumar, A., & Singh, P. (2023). Agile governance for smart city development: a case study of India. *Journal of Urban Management, 12*(1), 1-15.

Shi, D., & Cao, X. (2022). Research on the effectiveness of government governance in the context of smart cities. In *International Conference on Intelligent Traffic Systems and Smart City (ITSSC 2021)* (Vol. 12165, pp. 384-389). SPIE.

Silvia, C. (2011). Collaborative governance concepts for successful network leadership. *International Journal of Public Administration, 34*(8), 506–518. <https://doi.org/10.1080/01900692.2011.572056>

Sissons, A., & Thompson, S. (2012). Three-Dimensional Policy. *Why Britain Needs a Policy Framework for 3D Printing, The Work Foundation, Big Innovation Center, Lancaster University*.

Starc-Peceny, U., Maček, A., & Ovin, R. (2017). Evolution of marketing in smart cities through the collaboration design. In V. Bobek (Ed.), Management of cities and regions. IntechOpen. <https://doi.org/10.5772/intechopen.70646>

Sukmadiansyah, R., & Noviaristanti, S. (2022). Digital readiness analysis in Bandung government for smart city implementation. *International Journal of Management Finance and Accounting, 3*(1), 22–37. <https://doi.org/10.33093/ijomfa.3.1.2>

Šulyová, D., & Kubina, M. (2022). Integrated management of limited water resources in smart cities. *IOP Conference Series Earth and Environmental Science, 1077*(1), 012003. https://doi.org/10.1088/1755-1315/1077/1/012003

Szarek-Iwaniuk, P., & Senetra, A. (2020). Access to ICT in Poland and the co-creation of urban space in the process of modern social participation in a smart city – a case study. *Sustainability, 12*(5), 2136. <https://doi.org/10.3390/su12052136>

Tan, S. Y., & Taeihagh, A. (2020). Smart city governance in developing countries: A systematic literature review. *sustainability*, *12*(3), 899.

Tan, S. Y., & Taeihagh, A. (2020). Smart city governance in developing countries: A systematic literature review. *Urban Planning and Development*, 146(2), 04020015. [https://doi.org/10.1061/(ASCE)UP.1943-5444.0000600](https://doi.org/10.1061/%28ASCE%29UP.1943-5444.0000600)[arxiv.org](https://arxiv.org/abs/2001.10173?utm_source=chatgpt.com)

Triyanto, D., Warsono, H., & Herawati, A. (2022). A study collaborative governance in Bengkulu city, Indonesia. *Journal of Madani Society, 1*(1), 59–63. https://doi. org/10.56225/jmsc.v1i1.128

Turban, E., Pollard, C., & Wood, G. (2018). *Information technology for management: On-demand strategies for performance, growth and sustainability*. John Wiley & Sons.

United Nations Human Settlements Programme (UN-Habitat). (2025). *Monitoring smart inclusive transitions for an equitable urban future, using global urban monitoring framework*. <https://www.unhabitat.org/>

Viitanen, K. & Kingston, R. (2022). Agile governance for smart cities: a framework for managing agile projects. *Project Management Journal, 53*(1), 78 94.

Wang, K., Zhao, Y., Gangadhari, R. K., & Li, Z. (2022). Analyzing the adoption challenges of the Internet of Things (IoT) and Artificial Intelligence (AI) for smart cities in China. *arXiv*. <https://arxiv.org/abs/2205.01067>

Wen, M., Siqueira, R., Lago, N., Camarinha, D., Terceiro, A., Kon, F., & Meirelles, P. (2020). Leading successful government-academia collaborations using FLOSS and agile values. *Journal of Systems and Software*, *164*, 110548.

Wiecher, C., Tendyra, P., & Wolff, C. (2022). Scenario-based requirements engineering for complex smart city projects. *arXiv*. <https://arxiv.org/abs/2201.07115>[arxiv.org](https://arxiv.org/abs/2201.07115?utm_source=chatgpt.com)

Wijnhoven, F. (2018). Agile governance for smart cities: A framework for creating agile organizations. In Proceedings of the 16th International Conference on Digital Government Research (dg.o 2018). 1-10.

Xu, Y., Li, W., Tai, J., & Zhang, C. (2022). A bibliometric-based analytical framework for the study of smart city lifeforms in China. *International Journal of Environmental Research and Public Health, 19*(22), 14762. https://doi.org/10.3390/ ijerph192214762

Yandri, E., Setyobudi, R., Susanto, H., Kadri, A., Nugroho, Y., Wahono, S., Wijayanto, F., & Nurdiansyah, Y. (2020). Conceptualizing Indonesia’s ICT-based energy secu rity tracking system with detailed indicators from smart city extension. E3s Web of Conferences, 188, 00007. <https://doi.org/10.1051/e3sconf/202018800007>

Yigitcanlar, T., Kamruzzaman, M., Buys, L., Ioppolo, G., Sabatini-Marques, J., da Costa, E. M., & Yun, J. J. (2018). Understanding ‘smart cities’: Intertwining development drivers with desired outcomes in a multidimensional framework. *Cities*, *81*, 145-160.

Youssef, A., & Hajek, P. (2021). The role of smart economy in devel oping smart cities. In 2021 International symposium on computer science and intelligent controls (ISCSIC) (pp. 276–279). IEEE. https://doi.org/10.1109/ iscsic54682.2021.00057

Zanella, A., Bui, N., Castellani, A., Vangelista, L., & Zorzi, M. (2014). Internet of things for smart cities. *IEEE Internet of Things Journal, 1*(1), 22–32. https://doi.org/10.1109/JIOT.2014.2306328

Zhao, F., Fashola, O. I., Olarewaju, T. I., & Onwumere, I. (2021). Smart city research: A holistic and state-of-the-art literature review. Cities, 119, 103406. https://doi. org/10.1016/j.cities.2021.103406